APPENDIX B: APPROVED SAFETY MEASURES

Supplementary Safety Measures

Temporary Closure of a Public Highway-Rail Grade Crossing

This option requires closing the crossing to highway and pedestrian traffic during whistle ban periods.

Costs: The Chicago Area Transportation Study (CATS) estimates that it costs approximately $2,000 plus routine maintenance to temporarily close a crossing. Temporary closures usually require actual activation and deactivation of the closure mechanism in person. Unless the closure is seasonal or for a prolonged period of time, an authorized person must normally be available on a routine basis to open and close the crossing. Law enforcement officers or other authorized city personnel would have to incorporate this activity, which could occur up to four times daily to accommodate rush hour traffic, into their daily routine. Communities seeking other than seasonal whistle bans will probably elect to implement other SSMs.

Effectiveness: According to comments received from the Northwest Municipal Conference (NWMC), temporary closures may add to safety risk at other crossings as they divert highway traffic to nearby crossings that may not be as well protected. The NPRM assumed that 60 of 1978 grade crossings would be closed for some part of the day. The effectiveness rate associated with this SSM is 1.0. However, traffic must be distributed among adjacent crossings or grade separations for the purpose of estimating risk following the imposition of a whistle ban. Communities that will be closing crossings at the outer-bounds of quiet zones should consider any potential increases in risk to motorists who are diverted to crossings with higher risk levels that are not part of the quiet zone.

Permanent Closure of a Public Highway-Rail Grade Crossing

This option requires closing the crossing to highway and pedestrian traffic permanently. Communities that will be closing crossings at the outer-bounds of quiet zones should consider any potential increases in risk to motorists who are diverted to crossings with higher risk levels whether they are not part of the quiet zone or not.

Costs: CATS estimates that it costs approximately $5,000 to permanently close a grade crossing. Railroads usually provide some funding voluntarily to assist in the permanent closing crossings. Realistically, however, FRA does not expect very many communities to close crossings solely in response to this rule. When deciding whether to permanently close crossings, communities consider various other factors which carry more weight (e.g. the rerouting of highway vehicle traffic).

Effectiveness: The effectiveness rate associated with this SSM is 1.0.

Four-Quadrant Gate System

Typical crossing gate systems today have two gates on a two-way street. One gate is located on each side of the track(s), blocking traffic in the right lane(s) approaching the crossing. The opposing lanes are typically not blocked, which sometimes tempts motorists to drive onto the opposing lane and proceed around the gate and through the crossing. In a four-quadrant gate system, a sufficient number of gates are installed to fully block highway traffic from entering the crossing when the gates are lowered (median barrier optional) including at least one gate for each direction of traffic on each approach. When the gates are fully lowered, the gap between the ends of the gates must be less than two feet if there is no median between the lanes. If there is a median or channelization devices are installed, the gap between the gate and the median or channelization device must be within one foot. Four-quadrant gate systems will likely be installed at crossings with high levels of traffic.

Costs: Information available to FRA indicates that it costs an average of about $280,000 to install a four-quadrant gate system including constant warning time circuitry at a passively marked crossing and an average of approximately $100,000 to install 2 additional gates at a crossing already equipped with two-quadrant gates. Although some communities will elect to upgrade two-quadrant crossings to four-quadrant crossings, it is not likely that communities will install four-quadrant gate systems at crossings that do not already have gates.

For all gate installations, FRA is requiring constant warning time (CWT) devices to activate the gates to ensure that activation occurs at the same amount of time prior to the arrival of a train irrespective of speed. This should avoid long unnecessary waits at crossings that have very slow moving trains and discourage motorists from attempting to drive around gates to beat trains. FRA estimates that the additional cost for CWT devices is approximately $20,000 when gates are initially being installed and $40,000 when added to a flashing lights system that does not already accommodate the circuitry.

FRA is not requiring vehicle detection systems that are intended to keep exit gates up while vehicles remain in the crossing. Some communities where crossings and intersections are located in close proximity to one another may install these where necessary to prevent highway vehicles from becoming trapped in crossings as a result of long queues. Communities in the Chicago area would probably have to include vehicle detection systems as part of some of the four-quadrant gate systems. According to information regarding recent installations in the Chicago and St. Louis areas, it costs about $28,000 to install a standard six-loop configuration vehicle detection system at a crossing consisting of four highway lanes and two tracks.

Under current regulations (49 CFR 234), railroads are required to maintain automated warning devices, such as gates and lights at grade crossings. To the extent that, in response to this rule, communities install devices that have higher maintenance costs than existing devices, there will be

increased maintenance costs to the railroad. The additional cost for maintaining a four-quadrant gate system over a two-quadrant gate system is $2,500 per annum.

Effectiveness: The effectiveness of four-quadrant gates will vary depending on whether or not vehicle presence detection systems and medians are also installed. Vehicle presence detection systems which keep exit gates up longer may encourage motorists to follow violators through crossings using the oncoming traffic=s exit gate opening in a steady stream, defeating the intended warning. Some four-quadrant gate systems must include vehicle presence detection systems, especially in metropolitan areas where traffic signals may be in close proximity of grade crossings. Medians increase the efficiency of four-quadrant gates because they discourage the violation minded driver. Since vehicle presence detectors add expense and reduce the effectiveness of four-quadrant gate systems, they will likely only be installed to the extent the risk of having motor vehicles inadvertently caught in the middle of crossings is a concern.

Gates with Non-Mountable Medians or Mountable Medians with Channelization Devices

Opposing traffic lanes on both highway approaches to the crossing must be separated by either: (1) medians bounded by non-mountable curbs designed to discourage a motor vehicle from leaving the roadway (curb is 6 to 9 inches high), or (2) medians bounded by mountable curbs designed to permit a motor vehicle to leave a roadway when required (curb is 4 to 6 inches with a rounded top) if equipped with channelization devices (at least 2.5 feet high and no more than 7 feet apart). Such medians must extend at least 100 feet from the gate, unless there is an intersection within that distance. If so, the median or channelization devices must extend at least 60 feet from the gate. The gap between the lowered gate and the median or channelization devices must be one foot or less. As in other installations, “break-away” or frangible channelization devices must be monitored frequently, and broken elements replaced.

Costs: The regulatory evaluation of the NPRM presented an estimated installation cost of $11,070 for mountable medians with frangible delineators 100 feet on either side. CATS presented a cost of $15,000 in its comments to the NPRM. Ten crossings in the North Carolina Sealed Corridor were treated with traffic channelization devices between 1997 and 2000 at an average cost of $10,000 per crossing. To reflect more current levels of cost associated with such installations, this analysis uses an average cost per installation of $13,000.

Annual maintenance costs are approximately $500 for mountable medians with frangible delineators.

DuPage County, Illinois submitted a preliminary cost estimate of $15,000 for the installation of a two-foot concrete median on each approach to a crossing.

CATS also presented a $120,000 cost of installing a two-foot wide mountable permanent concrete barrier. Installation of such a barrier would require expansion of the roadway and relocation of

ravel lanes. Because installation of either detachable or permanent median barriers would suffice to meet the reduction in risk at affected crossings, communities will likely install the less expensive medians with channelization devices.

Feasibility: Although installation of gates with mountable median curbs and frangible delineators is the lowest cost SSM, installation will not be feasible at every crossing that requires an upgrade since they must extend for at least 60 feet on each approach. The Southern California Regional Rail Authority (Metrolink) operates over 399 at-grade crossings and 253 of these have median barriers in place. However, according Metrolink comments, design constraints at 92 crossings prohibit median installations.

One commenter indicated that snowplowing makes implementation of lower cost medians with frangible delineators in certain parts of the country infeasible because snowplows would destroy the delineators. FRA consulted with communities that use delineators to separate traffic flows and experience heavy snow. Such communities indicate that snowplow operators are trained to properly plow around delineators and have been doing so successfully for several years.

Effectiveness: This alternative safety measure is the most cost-effective for affected crossings where there are no intersections within 60 feet. At a crossing in North Carolina, 60-foot long channelization devices reduced violations by 77 percent during a 22-month period. FRA estimates that mountable curbs with channelization devices have an effectiveness rate of 0.75 (adjusted for novelty effect) and non-mountable curbs have an effectiveness rate of 0.80. In Spokane County, Washington, the Washington State Public Utilities Commission and the FRA worked together to test the effectiveness of non-mountable medians as a substitute for the use of locomotive horns. Results of this testing support the effectiveness rates cited in the NPRM.

<u>One Way Street With Gate(s)</u>

Gate(s) must be installed so that all approaching highway lanes to the public are completely blocked. There are two ways to accomplish this. Two gates can be used or one gate of extended length. If one gate is used, the arm must extend to within one foot of the far edge of the pavement and the edge of the road opposite the gate mechanism must have a barrier curb extending to and around the nearest intersection for at least 100 feet. If two gates are used, the gap between the gates when they are down must not exceed two feet. If the highway approach is equipped with a median, the lowered gates should reach to within one foot of the median. FRA is also requiring that newly installed gates systems be equipped with constant warning time systems.

Costs: In the case of pairing one-way streets that already have two-quadrant gates, the implementation cost is only for the relocation for one gate per crossing so that both gates are on the approaching side of the crossing. No additional gates should be required. FRA estimates it will cost approximately $35,000 to relocate one gate system. No incremental maintenance costs should be incurred as the number of gates at the crossing will not change.

Feasibility: At existing two-lane one-way streets, a long-arm gate could be installed or two gates could be used. In many areas it would be impractical to install long-arm gates because the additional length of the gate can greatly reduce the arms tolerance to strong winds. The additional weight of the longer arm can also present a challenge for standard motors used in normal arm length gate systems.

Although it is possible that communities will pair multi-lane one-way streets, it is not very likely that they will do so solely in response to this rule. Commenters from the Chicago area indicate that one way street designations in downtown areas have contributed to the failure of local business districts and are therefore do not make good business sense. One-way streets may limit access to businesses and therefore reduce sale volumes. Therefore this may be an uncommon alternative that is applied mainly in rural or largely residential and industrial areas.

Effectiveness: FRA does not have sufficient information regarding the effectiveness rate for one-way streets with gates. FRA conservatively estimates it will be about 0.82.

Alternate Safety Measures

Photo-Enforcement

Photo-enforcement systems involve the use of high-resolution cameras to photograph motorists who disobey traffic signals and provide one or more photographs of the vehicle, its license plate, and the driver's face as the basis for issuing a citation. Superimposed onto each photograph are the date, time and location of the violation, as well as the speed of the violating vehicle and the number of seconds of elapsed time since the red flashing lights were activated. FRA is requiring that state law authorize use of photographic evidence both to bring charges against a vehicle owner and sustain the burden of proof that a traffic law violation has occurred.

FRA is further requiring that (1) equipment be actually operating at each location at least 25% of each calendar quarter, (2) baseline violation rates are determined, and (3) violations be monitored for the next two calendar quarters, every other quarter until the crossing has five years of collision history with locomotive horns not sounding, and every fourth quarter thereafter.

Costs: The FRA, FHWA, and FTA funded an evaluation of the effectiveness of photo enforcement at the Southern California Regional Rail Authority (Metrolink) Pasadena Blue Line crossings. Initial costs were as follows:

High-resolution camera:	$50,000
Bulletproof cabinet and 12-foot pole:	4,500
Installation of pole, cabinet, and inductive roadway loops:	11,000
Total	$65,500

Annual costs for film processing (view film and issue tickets) were $24,000. In 1998, a digital video ticketing system was placed in service at a crossing in Salisbury, North Carolina at a cost of $55,000.

According to comments received from Du Page County, based on review of the Wood Dale, Illinois and future Naperville, Illinois demonstration projects and input from other entities, installation of one set of video detection equipment at one crossing can cost $100,000 and $7,500 annually to operate. For application to multiple crossings in a community individual crossing costs would decrease to 25% for installation due to equipment sharing and operating costs to $3,000 for each additional crossing.

For purposes of analysis, FRA is using an estimated initial cost of $65,500 for single crossing photo-enforcement programs and annual costs of $24,000. Communities may offset these costs by revenue generated from citation collection.

Since FRA is requiring that equipment be actually operating at each location for only 25 % of each calendar quarter, communities will probably rotate cameras between two to four crossings leaving dummy boxes in place at crossings without live equipment. Motorists will not know when they are actually being filmed, and very high levels of compliance may be achieved at significantly reduced cost. Assuming a ratio of one camera per every two crossings. Costs are distributed as follows:

Initial Costs	
High-resolution camera (1)	$50,000
Bulletproof cabinet and 12 foot pole (2 sets)	9,000
Installation of pole, cabinet, and inductive roadway loops (2)	22,000
Total for 2 crossings	$81,000
Total per crossing	$40,500

Similarly, for 3 and 4 crossings sharing equipment, the initial cost per crossing is about $32,167 and $28,000 respectively.

Annual Costs	
Film processing (view film and issue tickets)	$24,000
Rotate camera	800
Total for 2 crossings	$24,800
Total per crossing	$12,400

Similarly, for three and four crossings sharing equipment, annual costs per crossing are about $8,533 and $6,600, respectively.

The cabinet, pole, and inductive roadway loop maintenance is included in the annual maintenance costs.

Effectiveness: Before photo-enforcement, Naperville, Illinois documented over 340 motorist violations (going around the lowered gates five seconds after the lights started flashing) in 30 days. One year after photo-enforcement began, violations fell to 30 per month.

The Metrolink blue line photo-enforcement program was applied to an urban light rail environment and was combined with a public education and programmed enforcement effort. Two crossings were equipped with cameras. The first was at Van Nuys Boulevard, a busy arterial with 22,000 average daily motor vehicle trips, 28 daily weekday trains, and 8 daily weekend trains. The other was Goodwin Street, a residential street with 4,600 average daily motor vehicle trips, 76 daily weekday trains, and 18 weekend trains. The residential nature of this location lead Metrolink to believe the novelty effect would occur and violation rates would drop over time. Violation rates at Goodwin Street were low, so after 6 months, their cameras were moved to Chestnut Avenue, a feeder/collector street in Santa Ana with 7,000 average daily motor vehicles, 72 daily weekday trains and 22 weekend trains.

Violations were recorded at seven seconds after initiation of the warning devices at crossings. Two pictures are taken 1.1 seconds apart to determine that the vehicle was moving and calculate its speed. The cameras were rotated at Goodwin Street and Chestnut Avenue every three days from eastbound to westbound. The Metropolitan Transit Authority has a violation to conviction rate of 41 percent. Many times photos are not sufficiently clear and some vehicles do not have front license plates. During the project none of the cameras malfunctioned and relocation of the camera took only a few minutes. After the first month benchmark period, there was significant media coverage of the project.

At Van Nuys Boulevard, the number of average monthly trains increased from 596 to 660 between the benchmark period and the last month of the study period. Average monthly motor vehicle traffic declined from 670,000 to 624,000. The number of monthly violations also increased from 23 to 43. Violations per 100 trains increased from 4.4 to 6.0. At Goodwin Street eastbound the level of train traffic remained constant at 1,810 trains per month, average motor vehicle traffic decreased from 82,595 to 56,776, and violations increased from 6 in the benchmark month to 10 in the last month of the study. Violations per 100 trains increased from 0.33 to 0.55. At Goodwin Street westbound, the average number of monthly motor vehicles increased from 33,254 to 49,735. Train traffic levels remained constant. Violations increased from 4 monthly to 13 in the last month. Violations per 100 trains increased from 0.22 to 0.72 At Chestnut Avenue eastbound, the motor vehicle and train traffic levels remained constant while monthly violations decreased from 21 to 20. At Chestnut Avenue westbound, train traffic levels were unchanged and motor vehicle counts fell from 332,081 to 122,658. The number of monthly violations decreased from 29 in the first month to 14 in the last probably due to the reduction in motor vehicle traffic.

During the initial benchmark period (one month), the sites averaged 0.5 daily violations. At the end of the enforcement period, the sites averaged 0.46 daily violations. Violations decreased by 8 percent. According to Metrolink, 96.5% of the violations occurred before twelve seconds it takes a gate to come down completely. Metrolink concluded that most motorists are racing against gates and not trains. When comparing their results to those of other communities' experiences with photo-enforcement, Metrolink also concludes that the distance of 40 miles between the two locations where photo-enforcement was tested probably led to the lower effectiveness rates. If the crossings had been closer together they probably would have been more effective because

motorists would have been more likely to expect photo-enforcement activity at crossings in the vicinity and altered their driving behavior at crossings.

The Los Angeles photo-enforcement demonstration project showed that a carefully administered and well-publicized program of photo-enforcement reduced violation rates by 92 percent and collisions by 72 percent. Thus, the ratio of 72:92 or 0.7826 is the rate to be used to adjust reduced violation rates to estimate reductions in collisions for law enforcement and education/awareness options. Unfortunately, education and legal sanctions may lack effectiveness for several highway users. Therefore, at crossings with law enforcement and education/awareness options, violations must be reduced at least 49 percent (0.4852) in order to realize a 38 percent reduction in the risk of a collision.

Feasibility: Large-scale adoption of photo enforcement in Illinois, however, will require substantial outside funding as well as approval of the Illinois General Assembly. FRA believes that given the success experienced by photo-enforcement testing in Illinois shows that such systems can be implemented successfully. Therefore the General Assembly will probably soon approve the use of such systems. According to comments from the Chicago area, "Wood Dale has refined its photo enforcement system to account for complications associated with relying on evidence obtained from remote systems. As a result, Wood Dale's judicial success rate now reportedly exceeds 80 percent - a rate rivaling (and perhaps exceeding) the success of communities throughout the state who rely solely on conventional methods of enforcement." Furthermore, "The experience of Wood Dale testifies to the enormous potential of using video surveillance to abet enforcement. The city expects to issue more than 800 citations this year a number that will likely result in as many judgments against motorists as its single crossing than in the rest of the state combined." Wood Dale has been able to produce acceptable photographs of both the driver and the license plates, and to match vehicular information with other necessary data, to issue citations to about 40 percent of motorists who commit serious violations.

<u>Public Education and Awareness</u>

Public education and awareness programs are directed at motorists, pedestrians, and residents near the crossing to emphasize the risks associated with grade crossings and applicable requirements of state and local traffic laws at those crossings.

Educational programs may be and are often combined with enforcement programs. Police departments usually precede enforcement activities with educational efforts to increase awareness of railroad crossing dangers, to inform the public of the laws against violating railroad safety devices and of the departments' intention to enforce railroad crossing laws. Some activities to make people conscious of railroad safety are distributing informational pamphlets at crossings, display booths, posting the penalty for ignoring railroad crossing safety devices, and coordinating with

local media to publicize the program. As part of the awareness campaign, officers or other trained personnel (such as Operation Lifesaver volunteers) may present safety information at public places, such as malls, schools or libraries.

FRA believes that to implement a fully effective education and awareness program, a community would have to spend approximately $5,000 annually in materials. Labor associated with disseminating information is usually voluntary, but not always.

Effectiveness: As discussed in the section presenting costs associated with photo-enforcement, crossings with law enforcement and education/awareness options, violations must be reduced at least 49 percent (0.4852) in order to realize a 38 percent reduction in the risk of a collision.

DuPage County, Illinois comments indicate that the minimum violation rate reduction of 49% requirement for approval of enforcement and public awareness options is unfair to areas that have already implemented such efforts. A violation fine of $500, or 50 hours of community service for violating a railroad grade-crossing device was passed by Illinois in 1997. Their effectiveness is already being experienced. FRA believes that the effectiveness of such programs will be reflected in their actual past five-year relevant collision record. Well implemented programs should result in effectiveness levels that result in Quiet Zone Risk Indexes that are permissible under this rule without the addition of SSMs.

Programmed Enforcement

Programmed enforcement includes community and law enforcement programs with systematic and measurable crossing monitoring and traffic law enforcement activities aimed at reducing the number of motorists violating railroad crossing devices by changing their behavior. Enforcement activities may involve developing departmental policies on railroad safety, training officers in enforcing safety regulations, monitoring crossings and issuing citations, as well as collecting data on program effectiveness. Programmed enforcement may be implemented in conjunction with public education and awareness programs.

Costs: In 1997, FRA collected information from several municipalities on the costs of law enforcement programs and the revenues generated by such programs. FRA has updated those costs as follows:

Monitoring Costs

Number of Hours the Crossing was Monitored, Per Year:

1) Los Angeles	2080 or Full-Time
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois.	104 or 5% of Full-Time

The number of hours provided by the Elmhurst, IL Police Department is also used as an estimate for the other listed Illinois communities. The monitoring effort in Los Angeles was full-time.

Number of Officers Assigned to Monitor Crossings:

1) Los Angeles	10
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois.	11

Elmhurst data is used as an estimate for the other Illinois communities. Los Angeles data is from the MTA report cited above.

Annual Monitoring Cost @ $80,000 average annual burdened salary per officer

1) Los Angeles	$800,000
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois	$ 4,000

Number of Grade Crossings

1) Los Angeles	28
2) Berwyn, IL	8
3) Brookfield, IL	3
4) Elmhurst, IL	16
5) LaGrange, IL	12
6) Riverside, IL	9
7) Western Springs, IL	4
Total:	80

Annual Monitoring Cost per Crossing

1) Los Angeles	$28,571
2) Berwyn, IL	$ 500
3) Brookfield, IL	$ 1,333
4) Elmhurst, IL	$ 250
5) LaGrange, IL	$ 333
6) Riverside, IL	$ 444
7) Western Springs, IL	$ 1,000
Average annual monitoring costs per crossing:	$ 4,633

Training Costs

Operation Lifesaver Training

1) Tuition	$ 0
2) Materials	$ 40
3) Average Length of Course, in Hours	14
4) Opportunity Cost of Course, in Terms of Officers's Salary @ $38.46 per Hour	$ 538
5) Total Financial and Opportunity Cost per Officer	$ 578

Information from Operation Lifesaver, except officer salary information which is calculated from "I" above. Operation Lifesaver training courses are flexible and adaptable to local conditions. The data above are an average for a course recommended for training officers to enforce violators of railroad crossing safety devices and educate people on railroad safety issues.

Departmental/Municipal Training

1) Estimated Number of Hours	4
2) Opportunity Cost @ $38.46 per Hour per Officer	$ 154

A consideration of the time needed to review and discuss the railroad grade crossing enforcement policy of the department with officers.

Annual Training Cost per Crossing

1) Number of Operation Lifesaver Trained Officers in the 6 Illinois Communities	11
2) Total Departmental/Municipal Training Costs @ $154 per Officer	$ 1,694
3) Total Operation Lifesaver Training Costs @ $578 per Officer	$ 6,358
4) Total Training Costs	$ 8,052
5) Number of Grade Crossings in the 6 Illinois Communities	52
6) Average Training Cost per Crossing	$ 155

Based on the Illinois communities of Berwyn, Brookfield, Elmurst, LaGrange, Riverside, and Western Springs.

The average cost per crossing per year is $4,633.

Revenues: Violations will likely decrease somewhat over time as drivers become more aware of crossing laws, however FRA does not expect violations to decrease rapidly or cease to exist.[11] Revenue is dependent on the fine structure as well, Illinois has implemented a $500 fine for crossing violations. Each municipality that provided information to FRA has greater revenues than the cost of the program.

Ticket Revenues From Grade Crossing Violations

Number of Tickets Issued Annually

1) Los Angeles	15,736
2) Berwyn, IL	24
3) Brookfield, IL	7
4) Elmhurst, IL	83
5) LaGrange, IL	72
6) Riverside, IL	73
7) Western Springs, IL	42

Los Angeles tickets calculated from data in the MTA report, p. 3, and rounded to the nearest integer. Number of tickets for all Illinois communities except Elmhurst is from the West Central Municipal Conference (WCMC). Elmhurst, IL data is from the Elmhurst Police Department.

Annual Ticket Revenue @ $104 Fine collected per Ticket for Los Angeles and $200 Fine collected per Ticket for Illinois Communities

1) Los Angeles	$1,636,498
2) Berwyn, IL	$ 4,800
3) Brookfield, IL	$ 1,400
4) Elmhurst, IL	$ 16,600
5) LaGrange, IL	$ 14,400
6) Riverside, IL	$ 14,600
7) Western Springs, IL	$ 8,400

[11] A program that generates the feeling that crossing violations are socially unacceptable, similar to drunk driving campaigns, would be more likely to have a dramatic effect.

Annual Ticket Revenue per Crossing

1) Los Angeles	$	58,446
2) Berwyn, IL	$	600
3) Brookfield, IL	$	467
4) Elmhurst, IL	$	1,038
5) LaGrange, IL	$	1,200
6) Riverside, IL	$	1,622
7) Western Springs, IL	$	2,100

Average annual revenue per crossing is $9,353.

Effectiveness: See previous section addressing effectiveness of Public Education and Awareness.

Determination of Baseline Violation Rate and Semi-Annual Verification –

Photo-enforcement, programmed enforcement, and public education and awareness require establishment of baseline violation rates (number of violations/train movements). The baseline monitoring period must be a minimum of 4 weeks if conducted without public notice or media coverage and 16 weeks if conducted with public notice or media coverage. Once a baseline has been established, photo-enforcement may begin and violation rates must be monitored for the next 6 months. While the quiet zone has less than five years of collision history with locomotive horns not sounding, semi-annual analysis verifying the last quarters violation rates remain at or below the levels established prior to initiation of the program must be performed. Thereafter, analysis will required every fourth quarter. If the violation rate is ever greater than 49 percent below the baseline rate, procedures for dealing with unacceptable effectiveness rates must be followed. For purposes of this analysis, FRA is assuming that it will cost communities approximately $7,000 to establish a baseline, $3,000 annually to monitor violation rates until there is five years of collision history for the crossing, and $1,500 annually subsequently. If the level of effort is maintained, the effectiveness should be as well. FRA's monitoring via annual comparisons of the individual risk indexes to the NSRT should detect any significant decreases in the effectiveness of the programs.

Site Specific Costs

Actual site-specific costs may vary significantly from those presented in this document. Labor rates vary greatly within the various locations affected by this rulemaking. Crossing specific characteristics will also influence the actual cost of implementing safety measures.

Wayside Horns

FRA is allowing the use of wayside horns, which are placed at crossings and directed at oncoming motorists. Wayside horns are activated by the same track circuits used to detect the train's approach for purposes of other automated warning devices at the crossing. Use of wayside horns in lieu of train-mounted horns reduces net community noise impacts. Although wayside horns do

not provide motorists with information about the proximity, speed, and direction of approaching trains, demonstrations have thus far indicated that they may be as effective as train horns. This interim final rule permits their use as a one-for-one substitution at individual crossings either within or outside of quiet zones.

Effectiveness: Upon satisfactory results from a human factors study on automatic wayside horns, FRA will issue a finding of its effectiveness rate.